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Ames Research Center
Moffett Field, California 94035-1000

Rachel Prucey
Ames Research Center, Moffett Field, Calif.
650-604-0643
rachel.l.prucey@nasa.gov

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NASA SENDS CELLS INTO SPACE TO UNDERSTAND GROWTH AND INFECTION

MOFFETT FIELD, Calif. – NASA scientists are sending three fundamental life science experiments onboard space shuttle Discovery in hopes of better understanding exactly how spaceflight affects cell growth and how cells fight off infections. Future astronauts on long-term space missions need to understand how wounds heal and cells become infected in space to prevent illnesses during space travel.

When space shuttle Discovery hurtles into orbit after its April 5 scheduled launch, in addition to the multi-purpose logistics module filled with science racks for the laboratories aboard the station it will carry seven astronauts, two Space Tissue Loss experiments and 16 mice as it rendezvous with the International Space Station.

"As we expand humanity's reach to other planets we must learn how to live in space for prolonged periods of time," said Eduardo Almeida, the Space Tissue Loss's Stem Cell Regeneration experiment principal investigator and scientist at NASA's Ames Research Center, Moffett Field, Calif. "Understanding how space affects stem cell health is critical to exploration because our health relies on normal tissue repair and regenerative functions."

Stem Cell Regeneration experiment will study how embryonic stem cells develop into specialized tissue types, or "differentiate" in space. The experiment will use mouse embryonic stem cells and embryoid bodies, or ball-shaped collections of embryonic stem cells, as a model to study the effects of microgravity on adult stem cells' ability to carry out their normal function of repairing and regenerating tissues. Scientists compare the embryoid body to an early stage of development in mammals because embryonic stem cells can differentiate into any of the body's many cell types.

In the weeks leading up to launch, scientists working on the Stem Cell Regeneration experiment at NASA's Kennedy Space Center, Florida, grew mouse embryonic stem cells and prepared them for flight. Scientists will take the embryonic stems cells grown in the laboratory and place them into bioreactors, which are installed into an incubator that fits into a shuttle middeck locker, where they will remain during flight.

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"We are trying to get at the root cause of tissue degeneration in space," said Almeida. "We hope our research will help find preventive measures to address adult stem cell health in microgravity."

The second Space Tissue Loss (STL) experiment, STL-Immune, led by principal investigator Cheryl Nickerson, associate professor of life sciences at the Center for Infectious Diseases and Vaccinology in the Biodesign Institute at Arizona State University, will be the first fundamental biology experiment to conduct an in-flight infection of human cells using pathogenic bacteria. Nickerson's experiment will characterize the effect of microgravity on intestinal cellular responses before and after *Salmonella* infection during space flight.

"In addition, this experiment also closely monitors human cells giving us unique insight into conditions faced by astronauts during spaceflight, as well as how cells in our bodies normally behave or transition to disease caused by infection, immune disorders or cancer," said Nickerson. "Only by studying how cells respond to microgravity can we reveal important biological characteristics that are masked by normal gravity when using traditional experimental approaches on Earth." The Immune experiment will help scientists determine whether bacterial responses to spaceflight are also seen in human cells.

"Better understanding how microbes and human cells interact in space can lead to novel vaccines and therapeutics for the general public against infectious disease, as well as other human diseases," added Nickerson. "Our research has potential benefits and applications for life on Earth and astronauts on long-duration space missions."

Mouse Immunology, the third space-based experiment, will study the influence of microgravity on mice immune systems. The experiment's principal investigator, Millie Hughes-Fulford, former NASA astronaut and professor in the Departments of Medicine and Urology at the University of California, San Francisco will test whether an immune system response to a new infection or re-infection is affected by spaceflight.

"Mouse immunology will allow us to pinpoint which genes and pathways are or aren't working or performing well in space," said Hughes-Fulford. "We will examine all 8,000 genes of the mouse thymus cell to determine the molecular cause of a suppressed immune system."

Before launch, half of the mice in both the group that will fly to space and the control group that will stay on Earth received white blood cells that had been inoculated with thymus cells, or white blood cells, that were exposed to a foreign protein challenge. The other half of the mice will not be exposed until immediately after they return from space. Scientists will analyze whether the mice that received white blood cells react differently than those that were not pre-exposed.

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All three experiments are managed by the International Space Station Non-Exploration Projects Office at NASA Ames. The NASA Ames Flight Systems Implementation Branch and Space Biosciences Division developed and implemented the Mouse Immunology and Space Tissue Loss payloads, which were all funded by the Advanced Capabilities Division in the Exploration Systems Mission Directorate at NASA's Headquarters, Washington.

The Walter Reed Army Institute of Research, Silver Spring, Md., provided the hardware and the Department of Defense's Space Test Program developed the payload and managed the hardware integration for the Space Tissue Loss Experiments.

For more information about science on the International Space Station, visit:

http://www.nasa.gov/mission_pages/station/science

For more information about the Space Biosciences Division at NASA Ames, visit:

http://spacebiosciences.arc.nasa.gov

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